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SPERGULARIA IN NORTH AND SOUTH AMERICA RUTH P. ROSSBACH

(Plates 589-596)

INTRODUCTION

THE genus Spergularia (Pers.) J. & C. Presl¹ in North and South America includes forty species and varieties, five of which are introductions from other parts of the world. The genus reaches the height of its development in Chile where there are fourteen native species. Present collections of these indicate localized geographic distributions which, when studied in conjunction with the geology of the area and ecological conditions, should bring interesting results.

The genus was included in Arenaria by Linnaeus, Sp. Pl. (1753 & 1762) and Gen. Pl. ed. 5 (1754). Linnaeus also included one species of the genus under Alsine, Gen. Pl. ed. 5, 132 (1754). Alsine here included those species which are now known as Stellaria media and Spergularia segetalis; and Stellaria media is designated by the International Rules of Botanical Nomenclature as the type of Alsine. The first generic name used solely for the genus under discussion was Tissa Adans. Fam. ii. 507 (1763), which is immediately followed by another, Buda Adans. l. c., with no significant difference between the extremely cursory, tabular descriptions. In 1769, Mitchell, Princip. Bot. & Zool. App. Gen. Pl. 30, clearly separates the genus from Arenaria L. ¹ Fl. Cech. 94 (1819).

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as Corion, giving a good description. Corion, in addition, has a pre-Linnaean basis in Mitchell, Act. Nat. Cur. viii. (1748). In 1805, Persoon, Synop. Pl. i. 504, used Spergularia as the name for a section or subgenus under Arenaria, and in 1819 J. & C. Presl, Fl. Čech. 94, raised this section to generic rank. Spergularia is a nomen conservandum according to the Internat. Rules Bot. Nom., revised by Internat. Bot. Congress of Cambridge, 1930, Appendix III, and therefore must be used instead of Tissa Adans. or Buda Adans, which for very good reasons have become nomina rejicienda. Of the many generic synonyms after Spergularia (Pers.) J. & C. Presl (1819), Lepigonum Wahlb. Fl. Gothob. 45 (1820), with its basis in section Lepigonum of Arenaria Fries, Fl. Hall. Add. 159 (1817), is the only one which has received extensive use.

No attempt will be made further to discuss the history of the various species of Spergularia; one glance at the extent of the synonymy in the following pages will show that a general statement would necessarily be too long and too involved to be of any value. It is sufficient to say that many combinations have been made under the various generic synonyms, many entities described upon superficial characters, such as habit and amount of pubescence, and species already recognized often badly confused. Few students of the genus have noted the variation within one entity, and many have entirely disregarded seeds. Since seeds offer the most important diagnostic character and the general habit is so similar, the confusion of many workers is easily explained. It should be said, however, that the world monograph of Lepigonum by N. C. Kindberg (1863) deserves great praise. He clearly describes entities, giving exact measurements, and reveals careful examination of seeds. The illustrations are accurately and minutely done and, what is more remarkable for that early date, long synoptical treatments and careful citations of herbarium specimens are given. Much of the uncertainty evident in his treatment of American species is due to insufficient material.

In classifying Spergularias careful account, as already stated, should be taken of the seeds, size of mature capsule and its length in relation to sepals, type of inflorescence, size and quality of stipule, and type and degree of fasciculation of leaves. Many other characters serve as subordinate ones, such as number of stamens, length and degree of separation of styles, color of petals, and degree of pubescence.

The seeds of American Spergularias may vary in size from 0.35–1.4 mm. in length, S. platensis having the smallest, 0.35-0.4 mm., and S. canadensis the largest, 0.9-1.4 mm. The color of seeds varies from very light brown to red-brown, to dark brown, to black. Many species may have an iridescent or a silvery tinge in addition to the color. The surface of the seeds as seen by reflected light under the low power of a compound microscope may be smooth and dull in some species, as in S. denticulata, S. marina, S. canadensis, S. media, S. macrotheca, S. ramosa, S. rupestris, etc., or it may be very deeply sculptured in interwoven, vermiform pattern as in S. rubra, S. atrosperma, S. fasciculata, S. aberrans, S. levis, S. grandis, etc., or it may sometimes be roughened but in no regular pattern, as in S. Bocconi, S. platensis, S. pycnantha, etc. Again, the surface may be highly lustrous, as in S. stenocarpa and S. cremnophila. There should be an explanation of my use of the term vermiform. This is used to denote closely meandering lines upon the surface, as though a minute worm went back and forth in first this direction, then in that in search of food, leaving his trail behind. I have been unable to find any better term for this type of marking. Sometimes the superficial lines are in crude circles, giving an areolar appearance, and sometimes they are crowded together and deeply cut, making elongate ridges over the surface. Occasionally they are visible merely as very delicate traceries upon a smooth, dull surface, as in S. villosa or S. macrotheca. The type and presence of papillae are important, and these projections are, for convenience' sake, always considered as separate from the surface in the following treatment. The papillae may be nearly white and glandular to black and rigid and not glandular. They may be crowded upon the surface, giving an encrusted appearance, as in S. andina, S. platensis and S. collina, or they may be widely and regularly separated, as in S. ramosa, S. rupestris, or S. marina. Some species may always have papillae, as S. rubra, S. andina, S. floribunda, S. collina, S. levis, S. pazensis etc., while others never have papillae, as S. media, S. macrotheca, S. arbuscula and S. denticulata. There are many species, however, which may or may not have papillae, such as S. marina, S. canadensis, S. platensis, S. ramosa, S. villosa, S. fasciculata, S. pycnantha and S. diandra. Therefore, if papillae are present, it is important to examine them; if not, to note their absence; for these conditions in conjunction with other characteristics of the seed make it usually possible to identify the species by the seed alone. A characteristic of seeds long used and

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often discounted by workers is the presence of a wing. The seeds of many species are never winged, in a few they are always winged, as far as known at present, but in a great many they may or may not be winged. However, if the wing is present, its margin, its color, and its width should be noted. These features may also, in addition to the surface, color, and size, lead one to positive identification.

In addition to seeds, the size of the mature capsules or, in a general

way, the length of capsule compared to length of calyx may prove diagnostic. There are a few species in which the capsule is always shorter than the calyx and also a few in which it is always longer. However, there are a great many species in which the capsule may be slightly shorter than, equal to, or slightly longer than the calyx. The last cases show that the length of capsule, as compared to length of calyx, is at best a subordinate character.

In a few species the inflorescence may be short-noded and very crowded, as in S. arbuscula, S. Cerviana, S. floribunda and S. pycnantha. Other species may be much reduced in inflorescence, i. e. with only 1-3 flowers, as S. andina, S. depauperata and S. Pissisi. Many species may have lax, open, long inflorescences, as S. grandis, S. pazensis, S. macrotheca, S. villosa (sometimes), S. stenocarpa and S. levis. S. congestifolia is unique in having a minute-bracted inflorescence standing sharply differentiated, high above the crowded, leafy parts below. In many species, however, there is nothing striking about the inflorescence, which varies greatly in length of internodes and laxity. In some species the stipules may be small and roughly deltoid, as in S. canadensis, S. platensis, S. collina and S. ramosa var. diffusa. Other species may have very large (as much as 8 mm. in length), lanceolate-acuminate stipules, as in S. rupestris, S. levis, S. pazensis, S. ramosa, S. macrotheca, S. aberrans, S. pycnantha and S. villosa (sometimes), although even these may sometimes have smaller stipules of around 5 mm. or less in length. In S. congestifolia, S. arbuscula, and usually in S. fasciculata, the stipules are strongly lacerate. All the remaining species have medium-sized, non-distinctive stipules which show a great variation in size. Indeed, every species is variable as to stipules to such an extent that their characters must always be considered subordinate.

The leaves of all Spergularias are linear and usually mucronate. In some species they are generally shorter than in others, though

there is usually great variation in length. Some species always have nearly filiform, relatively non-fleshy leaves, as in S. rubra and S. congestifolia; others have them extremely fleshy, as in S. arbuscula, and usually in S. macrotheca, while others may have less fleshy leaves, as in S. fasciculata. More important than fleshiness is degree of fasciculation, which reaches its height in S. rubra, S. congestifolia, S. arbuscula, S. fasciculata, S. villosa and S. confertiflora. Other species never have fascicled leaves, such as S. canadensis, S. platensis and S. collina. There are a great many species, however, in which the leaves are usually not fascicled but are sometimes slightly so. It is evident from the above discussion that seed-differences are the most useful of diagnostic characters and that combinations of all other characteristics should supplement the study of seeds. However, it must be said that after long study of the many American species, one can become so well acquainted with them that new collections can quickly be sorted out almost without error without microscopic examination. This is due, I suppose, to the combinations of characters peculiar to each species.

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The following symbols have been employed in the citation of specimens from the above herbaria: United States National Herbarium (U. S.); Royal Botanic Gardens, Kew (K.); New York Botanical Garden (N. Y.); California Academy of Sciences (Cal. Acad.); Botanical Museum at Berlin-Dahlem (B.); Museo de La Plata (La

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SYNOPSIS OF SPERGULARIA IN NORTH AMERICA¹

- a. Plants perennial...b.
 - b. Seeds 0.7–0.9 mm. long, never papillose: styles 0.6–3 mm. long: sepals 5-10 mm. long: capsule robust. Styles 0.6-Styles 1.2–3 mm. long: petals white.
 - Styles 1.2–1.8 mm. long: capsule as much as 0.5–3 mm. longer than the calyx: seeds dark reddish-brown,
- Styles 2–3 mm. long: capsule equal to or as much as 1 mm. shorter than the calyx: seeds usually nearly black and ordinarily silvery tinged, commonly deeply sculptured in interwoven, vermiform, areolar b. Seeds 0.4-0.6 (rarely 0.65) mm. long, papillose or not: styles 0.2-0.6 mm. long: sepals 2-5 (rarely 5.2) mm. long: capsule more slender....c. c. Leaves not fascicled (rarely with one small, leafy branch in the axil), glabrous: root fleshy (fibrous, farinaceous), often 1 cm. thick: styles 0.2-0.4 mm. long: petals 1.2-2.4 mm. long: sepals glabrous or with only sparse, short, glandular pubescence: seeds brown, rounded in outline, sculptured in interwoven vermiform pattern, densely covered with large, glandular papillae which c. Leaves densely fascicled, glandular-pubescent: root heavy, ligneous, not farinaceous: styles 0.4-0.6 mm. long: petals 2.6-5 mm. long: sepals densely glandularpubsecent: seeds very dark brown, nearly black, pyriform, not sculptured, covered with widely spaced, hard, black, non-glandular papillae or not papillose, surrounded by a white, scarious, erose wing or not a. Plants annuals or short-lived perennials....d. d. Seeds black.

Seeds 0.6–0.8 mm. long, rounded in outline, often with an iridescent tinge, sculptured in interwoven, areolar vermiform pattern, often deeply so: capsule as much as 0.6-1.4 mm. longer than the calyx: stipules 1.8-2.8

¹ Measurements should be made to 0.1 mm. under a hand-lens and seeds should be examined under the low power of a compound microscope.

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. Seeds brown....e.

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e. Stamens 6-10....f.

f. Seeds smooth, not papillose, usually surrounded by a wing, occasionally not winged, 0.6-1.1 mm., usually 0.8-1 mm. long: capsule large, usually 5.5-7

	mm. long: large, robust plants, usually with fleshy
	leaves. 11. S. media.
	f. Seeds roughened or sculptured, always papillose, never winged, 0.4-0.6 mm. long: capsule smaller,
	2.8-5.4 mm. long: plants more delicate, usually with less fleshy leaves.
	Leaves densely fascicled, filiform, scarcely fleshy: seeds dark brown, deeply sculptured in closely interwoven, vermiform pattern; stipules triangu-
	lar-acuminate, conspicuous because of the large number of shining ones at a node, usually 3.5-5
	mm. long
	Leaves not fascicled or only slightly so, more fleshy: seeds very light brown, surface reticulated or
	roughened in no regular pattern: stipules deltoid,
	long
3.	Stamens $2-5, \ldots, g$.
	g. Seeds large, 0.9-1.4 (very rarely 0.8) mm. long, smooth or with irregular, reticulate thickenings,

partially or entirely surrounded by a white, scarious, erose wing or not winged, sometimes with long, delicate, glandular pubescence, especially on the swollen rim at the summit.

Prostrate or decumbent, always entirely glabrous except for the rarely sparsely glandular-pubescent pedicels: sepals always glabrous, blunttipped, 2.2-3.2 mm. long: mature capsule onceand-a-half to twice the length of the calyx....9. S. canadensis.
Erect or nearly so, glabrous or glandular-pubescent throughout: sepals not blunt-tipped, 3-4.6 mm. long: mature capsule less than one-and-a-half times the length of the calyx...10. S. canadensis, var. occidentalis.
g. Seeds 0.35-0.8 (very rarely 0.9) mm. long....h. h. Seeds 0.35-0.4 mm. long: infloresence a much

Seeds dull, smooth or occasionally only slightly roughened by raised thickened areas: stipules as long as or longer than broad, 2-4 mm., usually 2.5–3 mm. long: styles 0.4–0.6 mm. long. Inflorescence a lax cyme, not crowded: sepals 2.4-5 mm. long: mature capsule 3.6-6.4 mm. Inflorescence crowded, with many flowers: stems highly branched: sepals usually shorter, 1.6-3.8 mm. long: mature capsule usually shorter,

SYNOPSIS OF SPERGULARIA IN SOUTH AMERICA¹

- a. Stipules deeply lacerate, i. e. for one-third their length or more...b.
 - b. Inflorescence with much longer internodes than those of the stem, the inflorescence thus standing sharply differentiated high above the leafy lower parts: leaves short, filiform, falcate, densely fascicled: stipules lacerate for nearly two-thirds their length, giving the plant a silky appearance: fruiting pedicels long, the lowest 10-23 mm.:
 - b. Inflorescence with internodes not longer than those of stem, not sharply differentiated from the leafy parts below: leaves not falcate, filiform to very fleshy: stipules lacerate for one-half their length or less: fruiting pedicels usually shorter, often very short: seeds dark brown or black.
 - Small shrub: inflorescence a compact cyme with crowded internodes: sepals glabrous or slightly glandular-

pubescent at the base, 2.4-5 mm. long: petals 1.8-4 mm. long: styles 0.8-1.2 mm. long, separated to the base: mature capsule 1.6-3.6 mm. long: fruiting pedicels very short, the lowest 1-3 mm. long: seeds 0.6-0.8 mm. long, shining but never silvery, never winged .. 16. S. arbuscula. Perennial but not a shrub, *i. e.* herbaceous above the caudex: inflorescence a short, open cyme: sepals always glandular-pubescent, 5-10 mm. long: petals 4-10 mm. long: styles 1.5-2.5 mm. long, separating only partially, at the most 0.6 mm. from the apex: mature capsule 5-7 mm. long: fruiting pedicels 6-17 mm. long: seeds 0.8-1 mm. long, often with a silvery tinge, surrounded by a narrow, scarious wing or not

a. Stipules very shortly or not at all lacerate at the apex....c. c. Inflorescence with only 1-3 (rarely 4) flowers: plants with short internodes, usually forming low, thick mats....d. d. Sepals hooded at the apex: mature capsule 3-4 mm. long, exceeded by the calyx by as much as 0.5–1.2 mm.:

fruiting pedicels very short, 0.5–2.5 mm. long: seeds brown, deeply sculptured and covered with large,

glandular papillae which give them an encrusted d. Sepals blunt, not hooded, usually very fleshy: mature capsule 4.8-5.5 mm. long, equal to or but slightly exceeding the calyx, by as much as 0.5 mm.: fruiting

¹ Measurements should be made to 0.1 mm, with a hand-lens and seeds should be examined under the low power of a compound microscope.

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pedicels 3–15 mm. long: seeds only delicately sculptured, 0.8–1 mm. long, always surrounded by a scarious wing.

Seeds light brown, surrounded by a broad wing so deeply lacerate as to form strap-like appendages 0.3-0.6 mm. long, covered with regularly spaced, glandular hairs branched at the tips: internodes of stem below the inflorescence without corky appearance: leaves filiform, not fleshy, usually 7-13 mm. long, 0.5 mm. broad: fruiting pedicels 6-15 mm.

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Seeds dark brown, with a narrow, entire-margined wing 0.1 mm. wide, not papillose: internodes of stem below the inflorescence soft, with corky appearance: leaves linear, fleshy, 2-7 mm. long, 0.8-1 mm. broad: fruiting pedicels 3-5 mm. long....20.
c. Inflorescence more than 3-4-flowered: plants lax and spreading, not forming thick mats....e.

e. Seeds with broad, scarious wings 0.3-0.7 mm. wide and with nearly entire margins....f.

Central root fleshy and starchy, with a smooth, corky bark: styles 0.7-0.8 mm. long: leaves often spreading, giving a pseudoverticillate apS. Pissisi.

pearance: stipules usually shorter, almost deltoid, commonly 1.2-3 mm. long: mature capsule at least one-third longer than the calyx. . 36. S. ramosa, var. diffusa. f. Seeds dark, reddish brown or black, sculptured or not, papillose or not. Seeds sculptured and with or without dark papillae. Capsule 4-5-valved: styles 4-5: stems robust, Capsule 3-valved: styles 3: stems 0.8-1.5 mm. Seeds not sculptured but smooth or with low, e. Seeds with wings less than 0.3 mm. wide or if so broad with erose margins, or not winged. $\dots g$. g. Seeds brown, highly lustrous, smooth or only slightly sculptured. Mature capsule slender, 3.2–4.8 mm. long: stamens 5: seeds 0.4–0.7 mm. long, not winged but sometimes with an extremely narrow, brown rim. 23. S. stenocarpa. Mature capsule robust, 5-6.6 mm. long: stamens 8-10: seeds 0.7-1.2 mm. long, surrounded by a

g. Seeds not lustrous, smooth or deeply sculptured. . . . h.

- h. Sepals mucronate: plant annual: seeds brown,
- h. Sepals not mucronate....i.
 - i. Seeds black or dark brown, deeply sculptured in interwoven, vermiform pattern, 0.8-1 mm. long.....j.

- j. Stamens 5: seeds dark, sepia-brown, surrounded
- by a narrow, brown, sculptured wing....22. S. aberrans. j. Stamens 7-10....k.

 - k. Inflorescence an open, often lax cyme, densely glandular-pubescent: sepals dense-

ly glandular-pubescent, 5-10 mm. long. Inflorescence a short, open cyme, not lax: styles united for more than one-half their length: leaves densely fascicled, Inflorescence a lax cyme: styles divided to the base or united only rarely for as much as one-half their length: leaves usually not so densely fascicled. Seeds brown, dull, with only occasional, small papillae: mature capsule 5-6.6 mm. long, equal to or as much as 2.4 mm. shorter than the calyx: leaves Seeds very dark brown or black, glistening, nearly always covered with many, large, dark papillae: mature capsule usually much larger, 6.2-8.4 mm. long, equal to or up to 2 mm. longer than the calyx: leaves only 0.4-1 mm. i. Seeds light brown, or if dark brown or black less than 0.8 mm. long, or if 0.8-1 mm. long not sculptured and either light or dark brown....l. l. Sepals very short, 0.8-1.6 mm. long: plant glabrous throughout, very slender, with a much compounded cyme: seeds 0.35-0.4 mm. long, sculptured and usually papillose.33. S. platensis. l. Sepals longer, 2.2 mm. or more long....m. m. Capsule spherical: seeds black, densely covered with papillae, 0.4-0.7 mm. long, m. Capsule not spherical ... n. o. Seeds deeply sculptured in interwoven, vermiform pattern. Plant glabrous throughout: internodes 28-50 mm. long: leaves long, 22-80 mm.: capsule usually 6-8 mm. long, as much as 1.6-3.4 mm.

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capsule 5-5.2 mm. long, equaling or up to 1 mm. longer than the calyx: fruiting pedicels glandular-pubescent, the lowest 5–7 mm. long: ma-o. Seeds not sculptured. Stamens 7–10. Seeds 0.4-0.6 (rarely 0.65) mm. long, pyriform, very dark brown Seeds 0.7-1.1 mm. (very rarely 0.6 mm.) long, rounded in outline, light brown to dark brown. Seeds light brown, covered with brown papillae, 0.7-0.8 mm. long: mature capsule equal to or as much as 0.8 mm. shorter than the calyx: sepals densely glandular-pubescent: styles 1-Seeds dark brown, not papillose, 0.7-1.1 (rarely 0.6) mm. long: mature capsule usually 1-2.5 mm. longer than the calyx, rarely equaling it: sepals glabrous or only sparsely glandularpubescent: styles 0.5-1 mm. n. Seeds not winged...p. p. Stamens 6-10....q.q. Annual or sometimes a short-lived perennial....r. r. Seeds not sculptured but smooth or with low, elongate mounds, 0.7-1.1 (rarely 0.6) mm. long 11. S. media. r. Seeds sculptured or irregularly roughened and papillose, 0.4-0.8 mm. long. Seeds black, covered with long, large, black, glandular papillae: inflorescence widely angled: styles 0.8-1 mm. long.... 30. S. collina. Seeds brown, with minute, small, brown papillae: inflorescence crowded or lax but not widely angled: styles 0.4–0.8 mm. long. Leaves densely fascicled: stipules lanceolate-acuminate,

> shining, conspicuous because of their great number at an internode: styles 0.6– 0.8 mm. long: seeds dark brown, not silvery, deeply sculptured in closely interwoven, vermiform pattern....7. S. rubra. Leaves not fascicled or with only 1–2 minute leaves at the

axil: stipules deltoid or nearly so, dull, inconspicuous: styles 0.4–0.6 mm. long: seeds light brown, often silver-tinged, surface reticulated and roughened but in q. Perennials....s. s. Sepals glabrous but sometimes glandular-punctate. Seeds light brown, not papillose, but often with minute, elongate ridges, 0.5–0.6 mm. long: sepals recurved but incurved at the apex, often hooded, usually minutely glandular-punctate, especially on the upper parts: inflorescence a lax cyme....31. S. Spruceana. Seeds dark brown, covered with glandular papillae, 0.6–0.8 mm. long: sepals not recurved, nor hooded, nor glandular-punctate: inflorescence a compound cyme, usually crowded because of many capsules and short inter-s. Sepals glandular-pubescent. Capsule longer than the calyx: seeds dark brown, nearly black, pyriform, not sculptured but with regularly spaced, black papillae or not papillose, and with very delicate, vermiform traceries in areolar pattern, 0.4-0.6 (rarely 0.65) mm. long. 29. S. villosa. Capsule equal to or as much as 0.8 mm. shorter than the calyx: seeds brown, rounded in outline, sculptured in interwoven, vermiform pattern, with large, elongate, slightly curved papillae (some seeds having in addition some round papillae), 0.6–0.7 mm. long..... 28. S. confertiflora. p. Stamens 2-5. Annual: the non-sculptured seeds covered with glandular papillae or not papillose, 0.6-0.8 mm. long. 12. S. marina. Perennial: the sculptured seeds papillose or not, 0.3–0.5 mm. long. Whole plant glabrous: sepals 2.2-2.8 mm. long: capsule as much as 1-1.2 mm. longer than the calyx: stipules deltoid, 1.2-1.6 mm. long: cyme simple, not crowded. 34. S. platensis, var. Balansae. Whole plant densely glandularpubescent: sepals 3.6-4.6 mm. long: capsule equal to or as much

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as 0.8 mm. shorter than the calyx: stipules lanceolate-acuminate, 5– 7 mm. long: cyme compound and usually crowded by many capsules and short upper internodes. 27. S. pycnantha.

1. S. MACROTHECA (Hornem.) Heynh. (PLATE 589, FIGS. 1a-1c and MAP 1). Perennial: caudex branched, becoming woody with age, bearing from $1-\infty$ prostrate or semi-erect stems 3-45 cm. long; internodes of stem below the inflorescence glabrous or glandular-pubescent, 2-50 mm. long, 0.8-3 mm. in diameter: leaves fascicled or not, mucronate, fleshy, 0.6-3 mm. broad, 7-50 mm. long, glabrous to densely glandularpubescent; stipules conspicuous, triangular-acuminate, 4-11 mm., usually 6-9 mm. long: inflorescence always glandular-pubescent throughout, lax with long internodes or crowded with short internodes but with the internodes becoming shorter toward the apex, the lowest internodes 3-35 mm. long, 0.8-1.4 mm. broad: sepals broadly lanceolate, often attenuate, glandular-pubescent, 5-10 mm., usually 6-9 mm. long; petals ovate, nosy to light pink and perhaps occasionally white, 3.5-8, usually 4-6 mm. long, as much as 0.4-4 mm. shorter than calyx; stamens 10; styles 3, 0.6-1.2 mm. long, separated to base: mature capsules 5.5-10, usually 6-8 mm. long, 2 mm. shorter to 2 mm. longer than calyx: fruiting pedicels reflexed or not, the lowest 5-35 mm. long, 0.2-1, usually 0.6-0.8 mm. thick: seeds dark, reddish-brown, dull, nearly smooth or slightly hubbled with low, rounded mounds, usually not sculptured or with only scarcely discernible vermiform, areolar traceries or occasionally very obvious channels upon the surface, 0.6-1 mm., usually 0.7-0.9 mm. long, usually surrounded by a narrow, scarious, white or brownish, entire wing 0.2 mm. or less wide, or by a still narrower, opaque, brown rim, occasionally not winged.-Heynh. Nom. ii. 689 (1846); Robins. in Proc. Am. Acad. xxix. 312 (1894); Robins. in Gray, Synop. Fl. N. Am. i. 252 (1897); Jepson, Fl. Calif. 493 (1914); Jepson, Man. Fl. Pl. Calif. 360 (1923); Munz, Fl. S. Calif. 164 (1935); Macbride, Field Mus. Nat. Hist. Pub. Bot. xiii.-Fl. Peru, pt. ii. no. 2. 631 (1937), perhaps as to description but the species not known from Chile and Peru. Arenaria macrotheca Hornem. ex Cham. & Schlecht. in Linnaea, i. 53 (1826). Lepigonum macrothecum Fisch. & Mey. Ind. Sem. Hort. Petrop. iii. 14 (1837), nomen nudum; Kindb. Synop. Lepig. 14 (1856). Lepigonum macrothecum (Hornem.) Kindb. Mon. Lepig. 16, t. i. fig. i. (1861); Wats. Bibl. Index (Smithson. Misc. Coll. 258), 103 (1878); Brewer & Watson in Geol. Survey of California, Botany, i. 71 (1876). Spergularia rubra sensu Torrey, Pacific R. R. Report, Botany, iv. 70 (1857), in part (Corte Madera coll. includes 2 plants, S. macrotheca and S. media; Martinez collection not found), non Arenaria rubra L. (1753); sensu

¹ I have never seen any absolutely white in the field but some labels state distinctly that the flowers are white. It is possible that the very light pink tinge was not noticed.

Torrey, Wilkes Explor. Exped. xvii., Botany, 247 (1874), in part at least (including the Lower Sacramento coll. the Puget Sound coll. not found), non Arenaria rubra L. (1753). Tissa pallida Greene ex Britton in Bull. Torr. Bot. Club, xvi. 126 (1889) (Monterey, Meehan coll. not seen); Greene, Man. Bot. San Francisc. Bay, 36 (1894). Tissa macrotheca (Hornem.) Britt. in Bull. Torr. Bot. Club, xvi. 129 (May 8, 1889); Brandeg. in Proc. Calif. Acad., Ser. 2, ii. 131 (Nov. 12, 1889), probably, though Socorro, Lower Calif. coll. not seen; Greene, Man. Bot. San Francisc. Bay, 35 (1894); Jepson, Fl. W. Mid. Calif. 169 (1901); Howell, Fl. Northwest Coast, 88 (1903); Piper, Contrib. U. S. Nat. Herb. xi. (Fl. State Wash.), 263 (1906); Piper and Beattie, Fl. Northwest Coast, 145 (1915). Tissa macrotheca var. scariosa Britt. in Bull. Torr. Bot. Club, xvi. 129 (1889); Jepson, Fl. W. Mid. Calif. 170 (1901). Buda macrotheca (Hornem.) Kuntze, Rev. Gen. 50 (1891). Tissa Talinum Greene in Erythea, i. 106 (1893). Tissa valida Greene in Erythea, i. 107 (1893). Spergularia macrotheca var. scariosa (Britt.) Robins. in Proc. Am. Acad. xxix. 313 (1894) and Synop. Fl. i. 253 (1897); Jepson, Fl. Calif. 493 (1914) and Man. Fl. Pl. Calif. 360 (1923). Spergularia macrotheca var. Talinum (Greene) Jepson, Fl. Calif. 493 (1914) and Man. Fl. Pl. Calif. 360 (1923); Munz, Fl. S. Calif. 164 (1935). Alsine valida (Greene) House in Am. Midl. Nat. vii. 134 (1921). Alsine macrotheca (Hornem). House, l. c. Alsine Greenei House, I. c., renaming of Tissa pallida Greene.-NORTH AMERICA: along the Pacific Coast from northern Baja California to Vancouver Island, British Columbia. BAJA CALIFORNIA: San Quentin, E. Palmer 732, February, 1889 (U. S., G.); 23 miles south of Hamilton's Ranch, Santa Maria Plains, Wiggins 4537, March 23, 1930 (D. S.); Ensenada, M. E. Jones, April 11, 1882 (Pom.). Guadalupe Island, E. Palmer 864, March 29, 1889 (U. S., G., U. C., very thick, short, fleshy leaves); E. Palmer 864a, March 29, 1889 (U. S., Notre Dame, U. C., type collection of Tissa Talinum Greene, with short, glabrous, linear leaves); Rose 16027, March 2, 1911 (U. S., G., with glabrous linear leaves). CALIFORNIA: San Diego Co.: Oceanside, S. B. Parish 4451, June 11-16, 1897 (G., U. S.); sand dune strand, La Jolla, F. E. & E. S. Clements, March 14, 1914 (G.); sandy ocean beach, La Jolla, L. F. Henderson 13404, Jan. 31, 1931 (Ore.). Riverside Co.: alkaline marsh, Wildomar, I. M. Johnston 1872, April 27, 1918 (U. S., Pom.);¹ between Murietta and Temecula, Munz 2136, April 27, 1918 (Pom.).¹ Orange Co.: Newport Bay, Lawrence M. Booth 1062, May 19, 1932 (U. C., Pom.). Los Angeles Co.: moist ground of drying winter pool, mesa at north end of Baldwin Hills, Culver City, Ewan 7438, April 30, 1932 (U. C.); Ballona Harbor, Abrams 1223, April 1, 1901 (D. S., Pom.); east side of San Clemente Island, overhanging cliffs near the beach, Nell Murbarger 65, March, 1936 (U. C., with long lax stems and open inflorescence characteristic of S. macrotheca); sand dune, northwest coast, San Clemente Island, Munz 6608, April

¹ Even though on the coast, this collection has pink flowers and short styles.

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8, 1923 (Pom., U. C., G., large fleshy plants with many-flowered, open inflorescence, seeds 0.6-0.7 mm. long); San Clemente Island, M. E. Jones, September 9, 1926 (Pom., inflorescence dense, erect habit approaching Palmer 864 from Guadalupe Island, seeds 0.6-0.9 mm. long); San Clemente Island, Brandegee, August 25, 1894 (U. C., 2 sheets, heavy, fleshy plants, one with inflorescence sharply differentiated and the other not, seeds 0.8 mm. long, habit approaching Guadalupe Island plants, such as Palmer 864a and 864); low ground near beach, Little Harbor, Santa Catalina Island, M. B. Dunkle 1910, April 29, 1928 (Pom.); seaside, Avalon, Santa Catalina Island, Blanche Trask, May, 1896 (U. S.); back beach flat, Emerald Bay, Santa Catalina Island, M. B. Dunkle 1815, April 9, 1928 (Pom.). Ventura Co.: frequent along seashore, San Nicolas Island, Blanche Trask 25, April, 1901 (G.); Santa Barbara Island, Abrams & Wiggins 312, July 3, 1931 (U. C., Cal. Acad., D. S.); on dry clay flat, Anacapa Island, John T. Howell 3803, May 19, 1928 (Cal. Acad.); along beach, Ventura, Alice Eastwood 5026, April 17, 1916 (Cal. Acad.). Santa Barbara Co.: sand dunes adjacent to Santa Barbara, Eastwood, May 30, 1909 (Cal. Acad.); deep sand of ravines between high dunes, Surf, Grant, Ballon, & Ewan 7921, May 30, 1933 (Pom.); Santa Cruz Island, Greene, July and August, 1886 (U. C., D. S.), type coll. of Tissa valida Greene; heavy soil in grassy places near ranch, Santa Rosa Island, Munz & Crow 11747, April 9, 1930 (Pom.); San Miguel Island, Ralph Hoffmann, June 11, 1930 (Cal. Acad.). San Luis Obispo Co.: roadside, Cayucos, I. J. Condit, June 14, 1911 (U. C.); along Morro Bay, Eastwood 18874, April 19, 1935 (Cal. Acad.); Roosevelt Highway n. of San Simeon, Ynez Whilton Winblod, June 17, 1937 (Cal. Acad.). Monterey Co.: Point Sur, R. S. Ferris 3701, April 22, 1923 (D. S.); Point Lobos, Greene, July 1, 1891 (U. S., W., D. S.); on maritime rocks, Cypress Point, Monterey, A. Gray, February-May, 1885 (G., 1 low plants with short internodes); Pacific Grove, Tidestrom, June 6, 1893 (G., U. C., D. S., Pom.); Pacific Grove, Elmer 4387, June, 1903 (U. S., U. C., Pom., D. S., Ore.); Pacific Grove, Gwendolyn Newell, July 8, 1914 (G., Cal. Acad., seeds small, 0.6-0.7 mm. long, plants very lax and with long internodes); coast of Monterey, J. D. Hooker and A. Gray, Hayden's Survey of U. S. Territories, 1877 (G.,¹ lower internodes short but inflorescence open and high above). Santa Cruz Co.: ocean bluffs, Santa Cruz, Lewis S. Rose 35221, June 16, 1935 (Cal. Acad.). Santa Clara Co.: San Jose, Mrs. E. A. Bush, 1880 (U. S.). San Mateo Co.: in muddy clay at bottom

of a small gully in high sea cliffs, 3 miles south of Half Moon Bay, G. B. & R. P. Rossbach 608, November 25, 1937 (G., D. S.,² lax, long-

¹ Cited under Tissa macrotheca var. scariosa by Britt. in Bull. Torr. Bot. Club, xvi. 129 (1889).

² These three collections were made at the same time within a few feet of each other and show characteristic plants of *S. macrotheca* and of var. *scariosa* (Britt.) Robins. with transition stages. It may be seen that sheltered plants grow lax and longer-leaved, while plants in exposed places become compressed mats with shorter

stemmed plants); forming hanging mats and cushions in soft sandy soil, face of sea cliffs, same locality, G. B. & R. P. Rossbach 609, November 25, 1937 (G., D. S.);¹ on top of sea cliffs of crumbling rock and sandy soil, same locality, G. B. & R. P. Rossbach 610, November 25, 1937 (G., D. S.,¹ part of the plants with very short internodes, making plants small and congested); Belmont, Burtt Davy 809, April 17, 1893 (U. C.); mats on cliffs along coast, Montara Point, Copeland 3317, June 5, 1903 (U. S., G., Pom., U. C., determined as Tissa pallida by E. L. Greene). San Francisco Co.: bluffs near the sea, back of Lake Merced, Greene, June 9, 1887 (U. C., D. S., type collection of Tissa pallida Greene); saline soils, South San Francisco, Stewart H. Burnham 931, April 21, 1895 (Pom., both a long- and a short-internoded plant, the latter similar in habit to Guadalupe and San Clemente plants); Presidio, San Francisco, Heller 5700, June 12, 1902 (G., Pom., D. S., U. S.); near San Francisco, J. Torrey 41, 1865 (G., type collection of Tissa macrotheca var. scariosa Britt., with very short internodes); San Francisco, K. Brandegee June, 1890 (G., both short-internoded compressed and long-internoded lax plants in same collection); Farallone Island, L. M. Loomis, July, 1896 (U. C.). Contra Costa Co.: Point Richmond, H. M. Hall 1664, March 16, 1921 (U. C.). Alameda Co.: near Newark, Burtt Davy 1110, May 6, 1895 (U. C., G.); Mt. Eden, K. Brandegee, May 14, 1893 (G., U. C.; Gray spec. marked S. macrotheca var. leucantha, a form with roseate petals, by B. L. Robinson for Syn. Fl. N. Amer.). Napa Co.: Napa River levee at Cuttings Wharf, J. T. Howell 10803, October 8, 1932 (Cal. Acad.). Marin Co.: Corte Madera, J. M. Bigelow, 1853-4 (G., U. S.,² only part of the collection, the other plant being Spergularia media (L.) C. Presl); along roadside at edge of salt marsh at Stinson Beach, G. B. & R. P. Rossbach 606, May 26, 1938 (G., D. S., U. C., U. S.); Point Reyes, Burtt Davy 6773, June 18, 1900 (U. C., showing both lax, long-stemmed and matted, short-stemmed plants). Sonoma Co.: Bodega Point, Eastwood 4796, June 29, 1915 (U. S., G.); Bodega, Katherine Brandegee, June, 1905 (U. C.). Mendocino Co.: Mendocino, H. E. Brown 878, August, 1898 (G., U. S., a large cushion-forming plant with short internodes); Mendocino, Jos. McMurphy 39, July, 1903, (U. S., D. S., with long internodes). Humboldt Co.: plentiful in a salt flat between Eureka and Arcata, Heller 13780, July 9, 1923 (U. S., D. S.); Arcata, M. E. Jones 28873, July 16, 1931 (U. C., Pom.); salt marshes, Eureka,

leaves. This is true anywhere on the coast with similar variable habitats and therefore makes var. *scariosa* (Britt.) Robins. untenable.

¹ These three collections were made at the same time within a few feet of each other and show characteristic plants of *S. macrotheca* and of var. *scariosa* (Britt.) Robins. with transition stages. It may be seen that sheltered plants grow lax and longer-leaved, while plants in exposed places become compressed mats with shorter leaves. This is true anywhere on the coast with similar variable habitats and therefore makes var. *scariosa* (Britt.) Robins. untenable.

² Cited under Spergularia rubra by Torrey, Pacific R. R. Report., Botany iv. 70 (1857).

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Eastwood & Howell 3782, July 3, 1936 (Cal. Acad., G.). Del Norte Co.: Castle Island, near Crescent City, Mrs. G. Earle Kelly, June, 1924 (Cal. Acad.). California without definite locality: Lower Sacramento, Wilkes' Explor. Exped. (U. S.);¹ from sands in California, but collected from Berlin Bot. Gard., Schlechtendal, 1825 (B. TYPE, fragment G., photo. of fragment D. S.).² OREGON: Curry Co.: tide-lands, mouth of Chetco River, Henderson 9988, June 4, 1929 (Ore., U. C.). Coös Co.: banks and thickets, Marshfield, H. D. House 4989, September 1, 1912 (U. S.). Lane Co.: salt marshes, Florence, Henderson 16506, August 7, 1934 (Ore.). Lincoln Co.: beach, Seal Rock, 10 mi. s. of Newport, M. E. Peck 7269, September 5, 1917 (G.); Yachats, Sweetser, August 30, 1909 (Ore.); moist cliffs along the coast, Yaquina Bay, Henderson, July 12, 1881 (Ore., seeds small, around 0.6 mm. long, but plant lax and long-internoded, characteristic of the species). Tillamook Co.: tide-flats of Tillamook Bay, Bay Ocean, Henderson 11549, July 31, 1929 (Ore.); salt marshes, Tillamook, T. Howell, July, 1882 (Ore.). WASHINGTON: Pacific Co.: in marsh, tide-flat, North Cove, A. S. Forster 826, July 26, 1908 (U. S.). Clallam Co.: high beach, mouth of Quillayute River, I. C. Otis 1557, July 31, 1927 (W.); moist ground on sandspit at Port Angeles, J. W. Thompson 7852, August 10, 1931 (U. S., G., D. S., seeds 0.6-0.7 mm. long). San Juan Co.: Argyle, San Juan Island, S. M. & E. B. Zeller 937, June 25-August 1, 1917 (U. S.); Kanaka Bay, San Juan Island, Lucile Roush, June 29, 1919 (D. S.). BRITISH COLUMBIA: vicinity of Victoria, Vancouver Island, John Macoun 12, August 13, 1893 (U.S.); Victoria, John Macoun 2781, June 18, 1887 (U. S.); rock-crevices, Gonzales Point, Victoria, C. F. Newcombe, July 21, 1919 (D. S., Newcombe); Java Rocks, Haro Strait, W. A. Newcombe, May 7, 1934 (D. S., Newcombe).

The habit of S. macrotheca varies from robust, long-noded, manystemmed plants growing in rich, alkaline mud, to sprawling, slender, few-flowered ones inhibited by the crowding of other plants, or to short-stemmed, matted plants with crowded internodes, growing on cliffs exposed to sea-winds. This latter phase has been called var. scariosa by Britton and others, because of short internodes and heavy, glandular pubescence. More valuable diagnostic characters, such as

¹ Cited under Spergularia rubra by J. Torrey, Wilkes. Explor. Exped. xvii., Botany, 247 (1874).

² Cham. & Schlecht. in Linnaea, i. 53 (1826), published a previously inedited, botanical garden name of Hornemann for a plant growing in the Berlin Botanical Garden from seeds collected in sands of California by *Chamisso*. The plant in the Berlin Herbarium, a fragment of which is cited above, as in the Gray Herbarium, may then be taken as the type for *Arenaria macrotheca* Hornem., even though there should be a specimen at Leningrad where the chief collection of *Chamisso* is to be found (there is none in the first duplicate set in Berlin), the botanical garden plant would be the type because it was from that that the species was described.

seeds, stipules, flower- and fruit-measurements, all are the same as in more characteristic robust specimens of the species. In collecting almost anywhere on the cliffy shores of California, all stages in length of internode, size of plant and degree of pubescence may be found within a few feet of each other, one always finding that the scrubbiest plants grow in the most exposed places. Examples of this may be seen among the many collections from the Monterey peninsula, in collections made by the author at Half Moon Bay, San Mateo Co. (see note under citations), in the Copeland collection from Montara Point, San Mateo Co., among the many collections from San Francisco, and in the collection of J. Burtt Davy from Point Reyes, Marin Co. In addition, this compressed plant has no geographic range separate from that of the species. Tissa pallida Greene was described: "plant stout, very light colored" and it grew on "bluffs near the sea, back of Lake Merced" near San Francisco. The plant has capsules fully mature, so perhaps it was past its prime and losing some of its fresh green color. The plant is also far from stout for this species but like the common form on the moist sea-bluffs where it hangs in dense mats. Therefore, since all the diagnostic measurements are the same as those of S. macrotheca, there is nothing to distinguish this plant from the species. The type of *Tissa valida* Greene from Santa Cruz Island is a robust, glandular, heavily fruiting plant very characteristic of the common run of plants throughout the coast. There are no diagnostic characters making it different from the rest. At first there seems reason for keeping Tissa Talinum Greene from Guadalupe Island, Mexico, as an entity because of its extremely short-internoded habit and crowded, spreading, fleshy leaves, with a leafless, strict inflorescence standing definitely above the foliage. Even though some of the Guadalupe Island plants have no match in habit anywhere else, there are plants there which do have some bracts in the inflorescence (Howell 8329) and do not have a strict inflorescence standing high above the foliage (Palmer 864). The leaves are very variable, being linear-filiform, nearly glabrous, 2-5 cm. long and 1 mm. wide, as often as very fleshy, densely glandularpubescent, 1-2 cm. long and 3 mm. wide, with all stages between. One can scarcely use leaves as a diagnostic character. Guadalupe Island plants are always suffrutescent but so is the species often, throughout its range. This habit may be due to the drastic, desert

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conditions upon the island. The seeds of Guadalupe plants measure 0.5-0.7 mm. long. Although the seeds of S. macrotheca are usually 0.7-0.9 mm., they are occasionally 0.6 mm. long, as in the following collections: Munz 6608, San Clemente Island; Newell, Pacific Grove; Thompson 7852, Port Angeles, Washington. All of these collections are plants with long internodes and characteristic habit of the larger specimens of the species, and do not suggest the habit of any of the Guadalupe Island plants. It is significant that the collection of Marcus E. Jones from San Clemente Island, 1926, which has a habit somewhat suggesting T. Talinum in its spreading, densely fascicled leaves and erect, crowded inflorescence, has seeds all the way from 0.6 to 0.9 mm. in length. The collections of T. S. Brandegee, 1894, from San Clemente Island approach in habit the Guadalupe Island plants of Palmer but have seeds about 0.8 mm. long. The measurements of stipules and styles and the number of stamens are the same as in S. macrotheca, while measurements of capsule and sepals are included within the range of variation of, although smaller than the average of the species. All these facts, showing that Tissa Talinum is not consistently distinct in any character, make its taxonomic standing very weak.

2. Var. LEUCANTHA (Greene) Robinson (PLATE 589, FIG. 1d. and MAP 2). Sepals ovate-lanceolate, never attenuate, 4.5-7 mm., usually 5-6 mm. long; petals white or rarely pink-tinged, 4.5-7 mm., usually 5-6 mm. long, usually equal to or sometimes as much as 1 mm. longer than or shorter than the calyx; styles 1.2-1.8 mm. long: mature capsules 5.5-8 mm. long, rarely equal to the calyx,² usually exceeding it by as much as 0.5-3 mm.; seeds same as in the typical variety except that all examined were winged or rarely rimmed, and often shining.-Robins. in Proc. Am. Acad. xxix. 313 (1894) & in Gray, Synop. Fl. i. 253 (1897); Jepson, Fl. Calif. 493 (1914) and Man. Fl. Pl. Calif. 360 (1923); Munz, Fl. S. Calif. 164 (1935). Tissa leucantha Greene, Pitt. i. 301 (1889) and Man. Bot. San Francisc. Bay, 36 (1894). T. macrotheca var. leucantha (Greene) Jepson, Fl. W. Mid. Calif. 170 (1901). Alsine leucantha (Greene) House in Am. Midl. Nat. vii. 134 (1921). T. leucantha var. glabra Davidson in Bull. S. Calif. Acad. Sci. xxv. 84 (1926). S. macrotheca var. glabra (Davids.) Munz, Fl. S. Calif. 164

¹ The following have pink-tinged flowers: Stockton, E. E. Stanford 838 (U.S.); 5 miles n. of Tulare, Abrams 12022 (Pom.); San Jacinto, Street & Durant (Pom.). Specimens of all these collections are in the Dudley Herbarium of Stanford University but there the flowers are either white or discolored brown. The lack of pink color is probably due to poisoning.

² To be seen in plant from half way between Kerman & Mendota, Fresno Co., Keck & Stockwell, 3350, in which the calyx is distinctly equal to the capsule.

(1935).—NORTH AMERICA: only in California, in low, alkaline places of the interior valleys from San Diego Co. north to Colusa Co. CALI-FORNIA: San Diego Co.: Santa Maria, Alderson June, 1894 (U. C., G.). Riverside Co.: roadside in damp soil, San Jacinto, Street & Durant, May 12, 1918 (Pom., D. S.); vicinity of Perris, H. M. Hall 531, May 13, 1897 (U. C.). San Bernardino Co.: strongly alkaline soil, San Bernardino, Feudge 566, May 10, 1924 (Pom.); in alkaline soil, San Bernardino Valley, S. B. Parish 11719, April 13, 1918 (Cal. Acad.), same, April 20 (G.); vicinity of San Bernardino, S. B. Parish 4755, May 11, 1901 (D. S., Pom.). Los Angeles Co.: Studebaker, Braunton 307, May, 1902 (U. C., U. S.), in part;¹ near Dry Lake, Antelope Valley, Burtt Davy 2256, May 9-24, 1896 (U. C.); alkaline flats with Adelia neo-mexicana, 5 miles west of Lancaster on Antelope Valley Road, Ferris & Rossbach 9479, May 13, 1938 (D. S., G., calyx pubescent); roadside, Lancaster, Roxana S. Ferris 916, June 12, 1918 (Cal. Acad., D. S.). Tulare Co.: Goshen, K. Brandegee, May 9, 1916 (U. C.); 5 miles north of Tulare, Abrams 12022, May 2, 1927 (Pom., D. S.); alkaline flats, Hanford, Kearney 19, June 10, 1907 (U. S.). Kern Co.: Dry Lakes, Mohave Desert, Davidson 3618, May, 1926 (Pom., D. S.), type collection of Tissa leucantha var. glabra Davidson. Fresno Co.: in alkali, on flood plains of San Joaquin River, half way between Kerman & Mendota, Keck & Stockwell 3350, May 17, 1935 (D. S., calyx equal to capsule). Merced Co.: alkaline plains, 10 mi. sw. of Merced, J. T. Howell 1465, May 2, 1926 (Cal. Acad.). San Joaquin Co.: Lathrop, Greene, April 30, 1889 (U. C., U. S.), TYPE COLLECTION of Tissa leucantha Greene. Contra Costa Co.: Antioch, K. Brandegee, May, 1893 (G.). Solano Co.: Vanden, K. Brandegee, April 30, 1893 (G.); Vanden, Eastwood September 20, 1893 (G.). Yolo Co.: between Woodland and Davis, Abrams 12601, May 8, 1928 (Pom., D. S.). Sutter Co.: edge of tule land, Copeland 8273, May 29, 1903 (Pom.), det. by Greene. Colusa Co.: near Willows, Burtt Davy 4272, May, 1898 (U. C.); Colusa Junction, K. Brandegee, April, 1889 (G.).

This variety is easily distinguished from the typical form of the species by its longer stems and longer internodes, white flowers, usually more protruding capsule and somewhat longer style. It would be interesting to study flower-color in the field, for a few specimens in herbaria (see note above) seem to have pink flowers. Since flowercolor may change in drying, it may be that flowers of the species are

not always pink or rosy and that those of the variety are not always white.

Under Tissa leucantha, Greene cites three localities. The collection

¹Both the species and var. *leucantha* were mounted on the same sheet. Since these were supposedly collected from the same place it is interesting to note that even where the two entities come together their diagnostic characters remain distinct.

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from Lathrop is taken as the type. There are no Greene collections from Byron Springs and eastern Livermore Valley either at the University of California or the United States National Herbarium. These have not yet been located at Notre Dame but I venture to say that, because of the region from which they came, both the latter collections are probably of var. longistyla.

Var. glabra Davidson is characterized by being entirely glabrous. Careful examination of the type shows no other difference from the type or general collections of var. leucantha. The collection, Ferris & Rossbach 9479, taken not far from Davidson's type locality, however, shows pubescent calyces. I do not believe that a general absence of pubescence unsupported by other differences, even when the plants are all found in a given region, warrants their segregation as a variety.

3. Var. longistyla var. nov. (TAB. 589, FIG. 1e et 1f), sepalis ovato-lanceolatis, numquam attenuatis, 5.8-7 mm. longis; petalis albis, 5.8-7 mm. longis, sepala aequantibus vel eis 1 mm. longioribus vel brevioribus; stylis 3, ad basim divisis, 2-3 mm. longis: capsulis maturis, 4.6-6 mm. longis, sepala aequantibus vel eis ad 1.8 mm. brevioribus: seminibus eis var. typicae similibus aliquando autem fere nigris et argenteis, plerumque lineis vermiformibus dense intertextis profunde sculptis, areolis inter sculpturam parvis tumulis crebris.-CALIFORNIA: only in central California. Alameda Co.: Niles, M. E. Jones, April 10, 1934 (U. C., Pom.); Livermore, Michener & Bioletti, April, 1892 (U. S., U. C.); eastern Livermore Valley, J. T. Howell 13739, April 10, 1938 (Cal. Acad., good flowers); alkaline marsh along roadside, 1.5 miles west of Altamont, G. B. & R. P. Rossbach 611, June 5, 1938 (G. TYPE, D. S., U. S., Cal. Acad., U. C., Pom., B., Ore., N. Y., F. M.); alkaline mud, roadside, 1 mile n. of Mountain House, half way between Altamont and Tracy, G. B. & R. P. Rossbach 613, June 5, 1938 (G., D. S., Cal. Acad.); alkaline marsh along roadside about 1.5 miles east of Altamont, G. B. & R. P. Rossbach 614, December 30, 1937 (G.). Contra Costa Co.: Byron Springs, Burtt Davy, May, 1898 (U. C.); Byron Springs, Eastwood 11667, April 28, 1923 (Cal. Acad.); near Martinez, Burtt Davy, 6659, June 7, 1900 (U. C.). Napa Co.: Calistoga, Eastwood 4639, June 5, 1915 (Cal. Acad., G., U. S.); Calistoga, Eastwood, May 7, 1900 (G.); Calistoga Geyser, M. S. Baker 2111a, May 1, 1927 (D. S.); damp adobe meadow opposite Myrtledale Geyser, 1.5 miles north of Calistoga, Bacigalupi 1254, March 27-28, 1926 (D. S., Pom.); plentiful in stiff adobe near one of hot springs at Calistoga in the blue oak belt, Heller 13849, April 12, 1924 (U. S., D. S.); Myrtledale Hot Springs near Calistoga, J. T. Howell 1759, March 27, 1926 (Cal. Acad., D. S.); Myrtledale Hot Springs, *Eastwood & J. T. Howell* 5518, May 15, 1938 (Cal. Acad.).¹ MAP 3.

¹ Tulare Co.: 15.7 miles north of Tulare, F. R. Lawson R. 62, April 5, 1930 (D. S.)

This variety is distinguished from var. *leucantha* by its longer style, sculptured seeds and never protruding capsule but is similar in lax, long-internoded habit and white flowers. It differs from the typical variety in having white flowers and much longer style. All three entities are similar in fasciculation of leaves, in stipules, and in size of seed.

S. macrotheca itself occasionally has deeply sculptured seeds and the seeds of var. longistyla may have the surface softly hubbled and the sculpture only partially evident.

One plant¹ with pink flowers was found at the type locality. This had the capsule equal to and slightly exceeding the calyx, a short style 1.2 mm. long and smooth brown seeds with only delicate traceries and therefore is characteristic S. macrotheca.

4. S. MEXICANA Hemsl. (PLATE 589, FIGS. 4a-4c and MAP 4). Suffruticose perennial: tap-root fibrous-farinaceous, tapering gradually, often becoming 1 cm. thick: caudex well developed, knotty, branched or unbranched, bearing many (often 20-25) diffuse stems, 3-15 cm. long; internodes of stem below the inflorescence slender, 3-20, usually 6-13 mm. long, 0.5–1 mm. in diameter: leaves not fascicled (but sometimes small, leafy branches in the axils), linear-filiform, glabrous, mucronate, 5-15 mm. long, 0.5-1 mm. wide: stipules inconspicuous, triangularacuminate, scarious, 2-5 mm. long; inflorescence a lax cyme, 1.5-8 cm. long, with lower foliaceous bracts duplicating the vegetative leaves but becoming minute above, 2-5 mm. long, internodes glandular-pubescent, duplicating vegetative ones: sepals ovate-lanceolate, glabrous or with sparse, minute, glandular pubescence, scarious-margined, 2-4 mm. long; petals white, ovate, 1.2-2.4 mm. long; stamens 10; styles 3, 0.2-0.4 mm. long, dividing to base as the ovary matures: mature capsules 3-5 mm. long, exceeding calyx by 0.5-1.5 mm.: fruiting pedicels filiform, glandular-pubescent, often reflexed, the lower 2.5-10 mm. long: seeds brown, rounded in outline, somewhat sculptured in delicate, vermiform pattern, densely covered with large, glandular papillae which are often cup-shaped, 0.4-0.6 mm. long, not winged.-Hemsl. Diagn. Plant. Nov. pt. ii. 17 (1879) and Biol. Centr. Am. i. 72 (1879). S. neglecta sensu Hemsl. Biol. Centr. Am. i. 72 (1879), as to citation, Parry & Palmer 58, non S. neglecta Syme, Eng. Bot. ii. 129 (1864).²

has the style 3 mm. long and, though lacking mature capsules or seed, is probably var. longistyla, although all other collections in this vicinity have styles not over 1.8 mm. long and are var. leucantha. There is need of field investigation and mature specimens to check upon this locality.

11.5 miles west of Altamont, Alameda Co., G. B. & R. P. Rossbach 612, June 5, 1938 (D. S.).

² Which has its source in Lepigonum neglectum Kindb., Syn. Lepig. 6 (1856). Later in Kindberg, Mon. Lepig. 37 (1863), L. neglectum was given as a synonym of L. salinum (J. & C. Presl) Fries, which in turn is a synonym of Spergularia marina (L.) Griseb.

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Rhodora

MARCH

Tissa mexicana (Hemsl.) Britton in Bull. Torr. Bot. Club xvi. 129 (1889). Alsine mexicana (Hemsl.) House in Am. Midl. Nat. vii. 134 (1921), not A. mexicana Bartl. ex Presl, Rel. Haenk. ii. 14 (1825), which is Minuartia verna (L.) Hiern fide Prof. Johann Mattfeld in Fedde, Repert. Spec. Nov. Beihefte xv. 172 (1922). NORTH AMERICA: known only in Mexico in the states of San Luis Potosí and Hidalgo. MEXICO: SAN LUIS POTOSÍ: region of San Luis Potosí, alt. 6000-8000 ft., Parry & Palmer 52, 1878 (G., U. S.), type collection, TYPE at Kew, not seen; same data 58, 1878 (G.), type collection of Spergularia neglecta Hemsl., type at Kew, not seen; in sands around city, San Luis Potosí, Schaffner 137, 1876 (G.), 539, 1879 (U. S., Cal. Acad., B.). HIDALGO: bare hills above Pachuca, alt. 8500 ft., Pringle 6913, July 21, 1889 (G., U. S., B., W., U. C., Pom.). 5. S. atrosperma, spec. nov. (TAB. 589, FIG. 3a-3c). Annua: caulibus 1-8, erectis vel patentibus, 5-18 cm. longis: internodiis caulis partium efforiferarum gracilibus, glabris vel villoso-glandulosis, 4-35 mm. longis, 0.5–1.0 mm. crassis; foliis linearibus, carnosis, glabris vel villoso-glandulosis, mucronatis, non fasciculatis, 10-25 mm. longis, 0.5-1.2 mm. latis; stipulis late triangularibus, acuminatis, saepe paullo longioribus quam latis, 1.8-2.8 mm. longis: internodiis cymae filiformibus, glabris vel pubescenti-glandulosis, infimis 10-25 mm. longis: bracteis foliosis, supremis minimis; sepalis ovato-lanceolatis, glabris vel pubescenti-glandulosis, 2.8-4 mm. longis; petalis ovatis, albis vel roseis, 2–2.6 mm. longis; staminibus 4–8, saepe 1–2 abortivis vel ad basim connatis; stylis 0.5-0.8 mm. ad basim divisis: capsulis maturis 3.2-5 mm. longis, sepalis 0.6-1.4 mm. longioribus: pedicellis fructiferis reflexis vel non, filiformibus, plerumque pubescentiglandulosis, aliquando glabris, 4-8 mm. longis: seminibus nigris, saepe iridescentibus,¹ lineis vermiformibus intertextis areolatis sculptis, saepe profunde sculptis, haud papillatis, 0.6-0.8 mm. longis, non alatis vel aliquando ala imperfecta parva fusca scariosa vel margine angusto nigro.—Tissa diandra sensu Britt. in Bull. Torr. Bot. Club, xvi. 128 (1889), in small part, including only the collection "Sierra Valley, Lemmon," the remaining collections being of true S. diandra and S. echinosperma, q. v.; sensu Greene, Fl. Francisc. 128 (1891), entirely as to plants discussed; non Arenaria diandra Guss. (1827). Spergularia diandra sensu Robins. in Proc. Am. Acad. xxix. 310 (1894), in small part, including only the collection "Goshen, Brandegee," the remaining plants being S. diandra and S. echinosperma, q. v., non Arenaria diandra Guss. (1827).—NORTH AMERICA: only in alkaline places in California and adjacent Nevada. CALIFORNIA: Temecula, Riverside Co., M. E. Jones, April 24, 1882 (Pom.); dry mudflat, 1/2 mile south of Lake Elsinore, Riverside Co., Munz 5075, April 29, 1922 (Pom.); plains, Tulare, Tulare Co., K. Brandegee, April, 1889 (G.); Goshen, Tulare Co., K. Brandegee, April, 1893 (G.); Los Banos Hills, Merced Co., J. T. Howell 13826, May 28, 1938 (Cal. Acad. TYPE,

¹ These seeds are black but often have an iridescent tinge over the black.



Ranges of, 1, SPERGULARIA MACROTHECA (typical); 2, S. MACROTHECA var. LEUCANTHA; 3, S. MACROTHECA VAR. LONGISTYLA; 4, S. MEXICANA; 5, S. ATRO-SPERMA; 6, S. CANADENSIS and VAR. OCCIDENTALIS; 7, S. MARINA (with papillose seeds); 8, S. MARINA (with smooth seeds); 9, S. MARINA VAR. TENUIS; 10, S. ECHINOSPERMA; 11, S. CONGESTIFOLIA (also S. COLLINA); 12, S. ARBUSCULA; 13, S. FASCICULATA; 14, S. ANDINA; 15, S. DEPAUPERATA.

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MARCH

G., D. S., U. S., K., B.); clay soil, dried bed of former rain-pool, $7\frac{1}{2}$ miles sw. of Merced on Los Banos Road, San Joaquin Valley, Merced Co., J. T. Howell 4145, April 11, 1929 (Cal. Acad.); Merced Co., Mangst, May, 1886 (U. C.); moist alkali, south slope about 3 mi. up the canyon, Corral Hollow, San Joaquin Co., York, April 2, 1935 (D. S.); 4 miles east of Williams, alkali plains, Colusa Co., Roxana S. Ferris 509, April 12, 1917 (D. S.); Colusa Junction, Colusa Co., Brandegee, April, 1889 (G.); Sierra Valley, Sierra Co., Lemmon, June 22, 1874 (G.). NEVADA: alt. 5000 ft. south of Carson City, Ormsby Co., M. E. Jones, June 2, 1897 (U. S., Pom.). MAP 5.

S. atrosperma differs from S. diandra in having larger seeds, which are more coarsely sculptured and have an iridescent tinge, longer stipules, and usually a slightly larger capsule. Otherwise the two species may be easily confused. Examination of many Old World specimens of S. diandra has convinced me that the seeds of S. atrosperma, though similar, are too large to be included in the Old World species.

6. S. DIANDRA (Guss.) Boiss. (PLATE 589, FIGS. 5a-5c). Annual: with $2-\infty$ slender, prostrate or diffuse stems, 5-15 cm. long: internodes of stem below the inflorescence slender, glandular-pubescent to nearly glabrous, 4-23 mm. long, 0.4-1.2 mm. in diameter; leaves linear, glandular-pubescent, shortly mucronate, 10-25 mm. long, 0.5-1 mm. wide; stipules small, deltoid, acuminate, often slightly longer than broad, 1-2 mm. long; internodes of inflorescence glandular-pubescent, the lowest 7-18 mm. long; bracts foliaceous, becoming minute above, 2-15 mm. long: sepals ovate-lanceolate, blunt-tipped, glandularpubescent, 2.6-3.6 mm. long; petals rosy or white with pink toward the apices, ovate, 1.8-2.8 mm. long, as much as 0.5-1.2 mm. shorter than the calyx; stamens 4-7; styles 3, separated to the base, 0.4-0.6 mm. long; mature capsules almost globose, 2.6-4 mm. long, equal to or as much as 0.5 mm. longer than the calyx: fruiting pedicels filiform, glandular-pubescent, erect or spreading, 4-11 mm. long: seeds black with a silvery tinge, pyriform, usually sculptured in interwoven, vermiform pattern, so that there are narrow, short, molded ridges between, occasionally nearly smooth, sometimes with scattered, small, black papillae, 0.4-0.5 mm. long, not winged.-Fl. Orient. i. 733 (1867); Robins. in Proc. Am. Acad. xxix. 310 (1894), in part, including only the Oregon and Washington plants, excluding the California and Texan collections which are S. atrosperma and S. echinosperma respectively. Arenaria diandra Guss. Prod. Sic. i. 515 (1827). A. salsuginea Bunge in Ledeb. Fl. Alt. ii. 163 (1830); Ledeb. Ic. Pl. Fl. Ross. Alt. Illus. v. t. 409 (1834), although no previous author cited. Alsine diandra (Guss.) Guss. Fl. Sic. Syn. i. 501 (1842); House in Am. Midl. Nat. vii. 134 (1921). Spergularia salsuginea (Bunge) Fenzl in Ledeb. Fl. Ross. ii. 166 (1844-46); Robins. in Gray, Synop. Fl. 251 (1897). Lepigonum diandrum (Guss.) Nym. Syll. Fl. Eur. 250

(1854-55); Kindb. Synop. Lepig. 7 (1856), as to source of name not as to plants described.¹ L. salsugineum (Bunge) Fisch. & Meyer, Ind. Sem. Hort. Petrop. i. 10 (1835); Kindb. Synop. Lepig. 7 (1856) and Mon. Lepig. 42. t. iii. fig. 30 (1863). S. atheniensis Heldr. & Sart. ex Nym. Consp. 123 (1878-1882), an herbarium name given as a synonym of S. diandra (Guss.) Boiss. Tissa diandra (Guss.) Britt. in Bull. Torr. Bot. Club, xvi. 128 (1889), in part, including only Suksdorf and Henderson collections, excluding the Californian and Texan collections; Brandegee, Proc. Calif. Acad. ser. 2. ii. 131 (1889), as to source of name, not as to plants discussed which are S. marina; Howell, Fl. Nw. Coast, 89 (1903), in part, including Columbia valley plants, excluding the Texan plants. Buda diandra (Guss.) Kuntze, Rev. Gen. 50 (1891). S. salsuginea var. bracteata Robins. in Gray, Synop. Fl. i. 251 (1897), in part, including the Oregon and Washington plants, excluding the Texan collections. Tissa bracteata (Robins.) Small, Fl. Se. U. S. 418 (1903), in part, including only the Washington plants, excluding the Californian and Texan collections. T. diandra var. bracteata (Robins.) Piper in Contrib. U. S. Nat. Herb. xi. (Fl. State Wash.) 264 (1906), in part, including the Suksdorf collections, excluding Sandberg & Leiberg 346, which is S. marina; Piper & Beattie, Fl. Se. Wash. and Adjac. Idaho, 98 (1914). S. bracteata (Robins.) Nelson & Macbride in Bot. Gaz. lxi. 30 (1916); St. John, Fl. Se. Wash. and Adjac. Idaho, 144 (1937). Alsine bracteata (Robins.) House in Am. Midl. Nat. vii. 134 (1921).—NORTH AMERICA: introduced from the Old World² into Oregon, Washington, and Idaho in the Columbia and Snake River valleys; and perhaps locally in Massachusetts and Georgia. OREGON: roadsides, Oswego, Clackamas Co., Howell, June, 1888 (Ore.); muddy shore of Columbia River, on Hayden Island, opposite Vancouver, Wash., J. C. Nelson 2958, Oct. 11, 1919 (G.). WASHINGTON: sandy bank of the Columbia River, w. Klickitat Co., Suksdorf 176, September, 1883 (G.); same loc. and collector, 2082, October 18, November, 1891 (G., U. S., U. C.); sandy river bank, Bingen, w. Klickitat Co., Suksdorf 2082, September-November, 1904, April, 1891 (U. C., D. S., Ore.). IDAHO: gravel bars, alt. 3500 ft., Boulder Creek, Owyhee Co., Macbride 514, July 31, 1910 (G., U. S., D. S.).

The following specimens agree well but not exactly with the above plants. They are placed here for lack of thorough knowledge of Old World species to one of which they certainly must belong.

MASSACHUSETTS: Patuisset Island, Pocasset, Bourne, Barnstable Co., J. A. Cushman 8512, August 14, 1912 (New England Bot. Club). GEORGIA: Biltmore Herbarium, no collector, 1685a, Camden Co., March 29, 1902 (D. S., Pom.).

(To be continued)

¹Later in 1863, Kindberg, Mon. Lepig. 35, refers this to Lepigonum campestre Kindb., which equals S. Bocconi (Scheele) Foucaud.

²Old World specimens from Spain, Greece, Tripoli, Morocco and Central Asia have been examined by the author.